Winter 2012-2013 Outlook for Colorado

Mike Baker National Weather Service Boulder, Colorado October 23, 2012





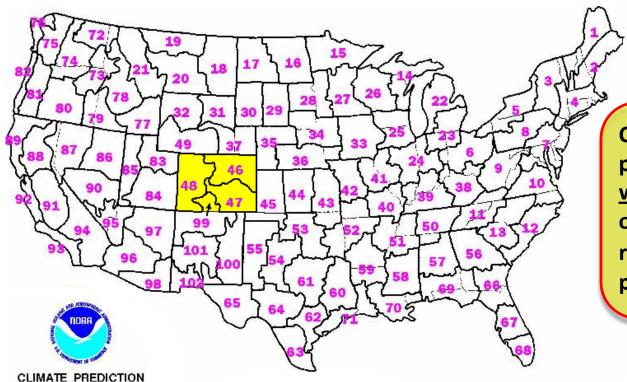
November 2012-January 2013
Temperature and Precipitation
Outlook for Colorado
Issued by the
Climate Prediction Center

Climate Prediction Center Seasonal Outlooks

The National Weather Service Seasonal Climate Outlooks predict the probability of conditions being among the warmest/coldest or wettest/driest terciles of years compared to the period of record 1981-2010.

The outlooks indicate probability of being in three specific categories in reference to the 30-year climatology from 1981-2010. They are above, below and average.

Remember, Climate Predicition Center (CPC) outlooks are made at the scale of the climate megadividions (see the map below).

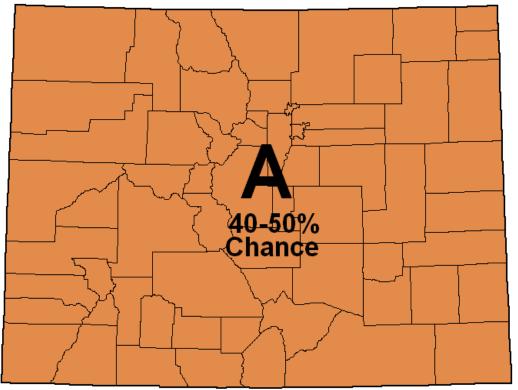


CENTER

Remember...

CPC outlooks do not predict the degree of warmness or coldness, or how wet or dry a region will be; only their probability of occurrence.





One-Month Outlook Temperature Probability 0.5 Month Lead Valid Nov 2012

Made: 18 Oct 2012

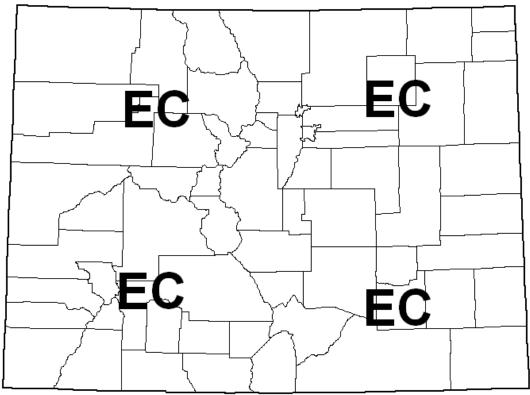
- A Means Above Normal (Average)
- N Means Normal (Average)
- B Means Below Normal (Average)
- EC Means Equal (or Undetermined) Chances for A, N and B

Source: NOAA/Climate Prediction Center

November 2012 Temperature Outlook for Colorado

Climate Prediction Center (CPC) predicts a 40 to 50 percent chance of above-average temperature across all of Colorado during the month of November.

November 2012 Precipitation Outlook for Colorado



One-Month Outlook Precipitation Probability 0.5 Month Lead Valid Nov 2012

Made: 18 Oct 2012

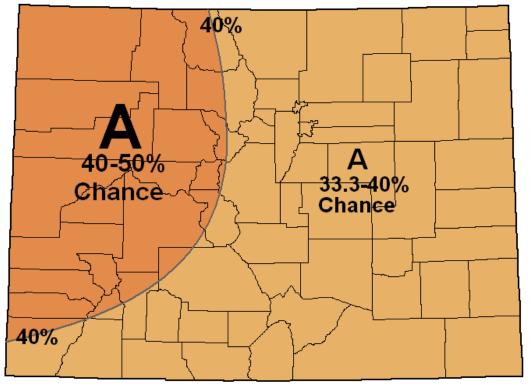
- A Means Above Normal (Average)
- N Means Normal (Average)
- B Means Below Normal (Average)
- EC Means Equal (or Undetermined)
 Chances for A, N and B

Source: NOAA/Climate Prediction Center

November 2012 Precipitation Outlook for Colorado

CPC is predicting an equal or (undeterminable) chance (EC) for above-, below- and near-average precipitation across Colorado during November.

November 2012-January 2013 Temperature Outlook for Colorado



Three-Month Outlook Temperature Probability 0.5 Month Lead Valid NDJ 2012 Made: 18 Oct 2012

- A Means Above Normal (Average)
- N Means Normal (Average)
- B Means Below Normal (Average)
- EC Means Equal (or Undetermined) Chances for A, N and B

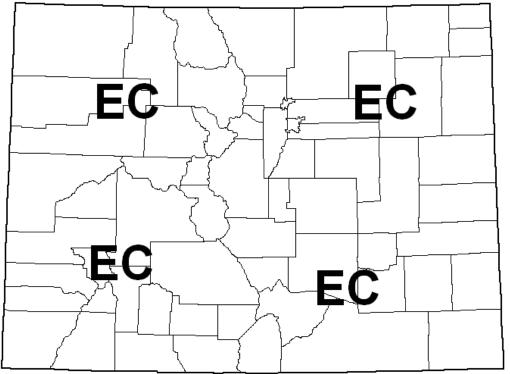
Source: NOAA/Climate Prediction Center

November 2012-January 2013 Temperature Outlook for Colorado

The outlook for November 2012-January 2013 climate season calls for a 40 to 50 percent chance of above-average temperature for the western one-third of Colorado, and a slightly lower chance (a 33.3 to 40 percent) for above-average temperature for the remainder of the state.

Keep in mind, this outlook does not infer any degree of warmness or coldness. It is only a probability that these conditions will happen.

November 2012-January 2013 Precipitation Outlook for Colorado



Three-Month Outlook Precipitation Probability 0.5 Month Lead Valid NDJ 2012 Made: Oct 18 2012

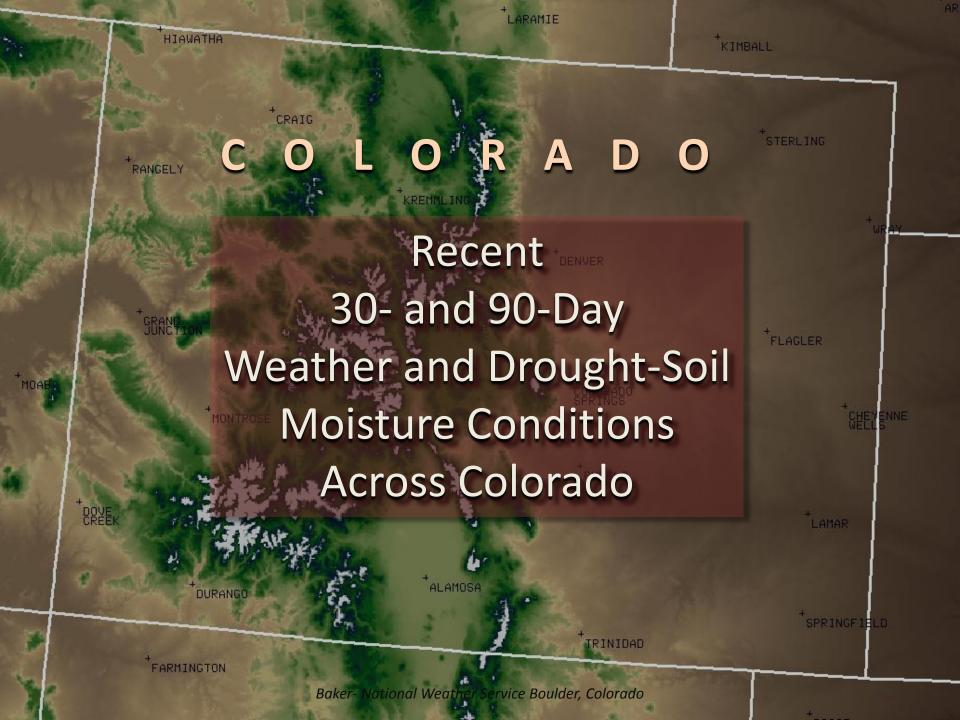
- A Means Above Normal (Average)
- N Means Normal (Average)
- B Means Below Normal (Average)
- EC Means Equal (or Undetermined) Chances for A, N and B

Source: NOAA/Climate Prediction Center

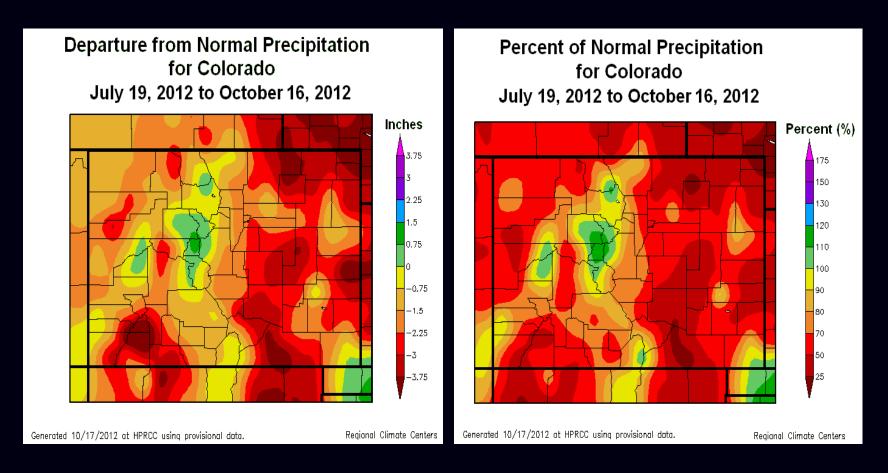
November 2012-January 2013 Precipitation Outlook for Colorado

Lastly, CPC is calling for an equal (or undeterminable) chance (EC) for above-, belowand near-average precipitation across Colorado during the November 2012-January 2013 climate season.

Let's Apply CPC's
Climate Outlook
More Closely
To Colorado

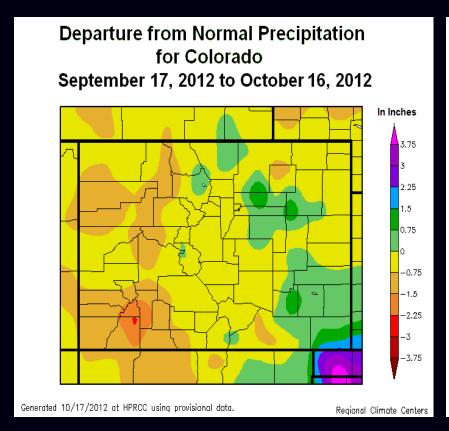


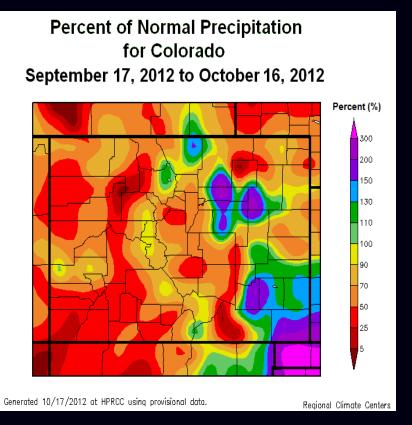
Precipitation for the 90-Day Period Ending October 16, 2012



Precipitation during the recent 90-day period ending October 16th was below to much below average for nearly all of Colorado. Exceptions include the pockets of above average precipitation in the mountains and high valleys of west central Colorado and extreme southeast corner of the state.

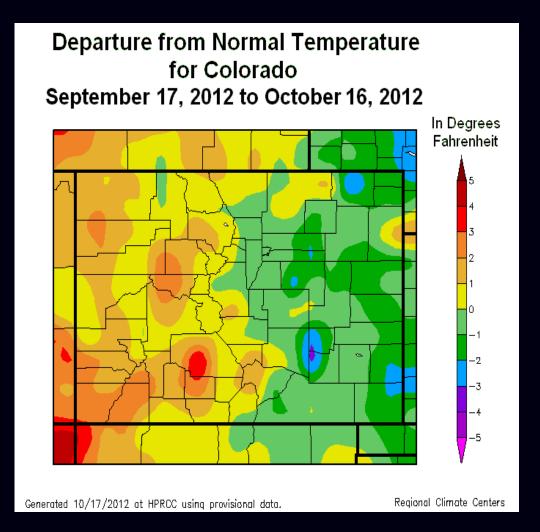
Precipitation for the 30-Day Period Ending October 16, 2012





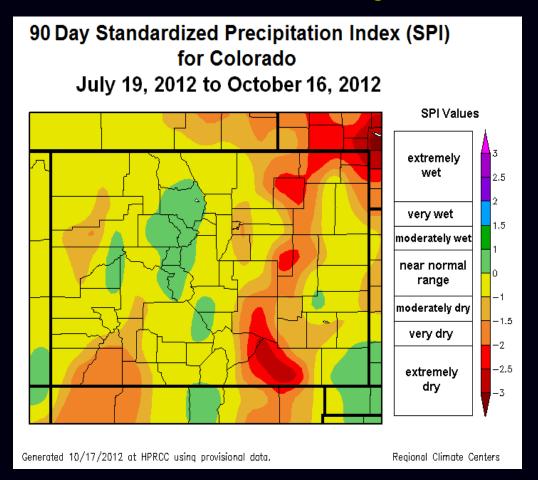
It is evident from this set of maps that there was a significant increase in precipitation during the more recent 30-day period ending October 16th. While portions of western and south central Colorado continued to record below average precipitation, the remainder of the state saw a number of storm events during September and early October that resulted in above to much above average precipitation during this 30 day period.

Temperature for the 30-Day Period Ending October 16, 2012



Temperatures during this latest 30-day period ranged from 1 to 3 degrees F below average in eastern Colorado, to generally 1 to 3 degrees above average across western Colorado. Exceptions include the hot spot in Gunnison County in southwest Colorado and the cold spot just east of Pueblo in southeast Colorado.

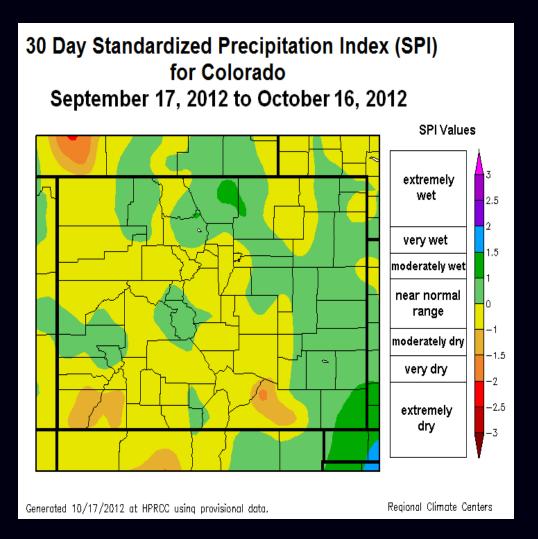
Soil Moisture Conditions for the 90-Day Period Ending October 16, 2012



The Standardized Precipitation Index (SPI) for the recent 90-day period ending October 16, 2012, indicates moderate to very dry conditions across most of Colorado due, in large part, to the lack of precipitation during the first 60 days of this period. However, during the last 30 days of this period, monsoon rains managed to moisten soils in the mountains and high valleys of central Colorado. An uptick in late summer thunderstorm activity also helped to improve soil moisture across the extreme southeast corner of the state.

The SPI was developed to monitor potential short term agricultural and long-term hydrological drought conditions. The SPI is a probability index that considers <u>only</u> precipitation.

Soil Moisture Conditions for the 30-Day Period Ending October 16, 2012



The Standardized Precipitation Index (SPI) for the more recent 30-day period ending October 16, 2012, indicates a sizable improvement in soil moistures for portions of north central and eastern Colorado. There was also some improvement across southwest Colorado largely due to a brief resurgence in monsoon thunderstorm activity during late August and early September. The most noticeable improvement in soil moistures occurred along the northern Front Range around Fort Collins, the far northeast plains, and across the extreme southeast corner of the state.

U.S. Drought Monitor

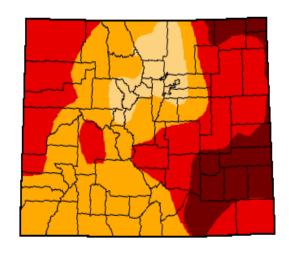
October 16, 2012

Valid 7 a.m. EST

Colorado

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	91.36	51.05	14.01
Last Week (10/09/2012 map)	0.00	100.00	100.00	91.93	53.07	14.02
3 Months Ago (07/17/2012 map)	0.00	100.00	100.00	100.00	70.46	1.77
Start of Calendar Year (12/27/2011 map)	67.79	32.21	24.98	14.94	0.04	0.00
Start of Water Year (09/25/2012 map)	0.00	100.00	100.00	100.00	61.75	16.89
One Year Ago (10/11/2011 map)	62.59	37.41	27.42	19.99	6.46	0.57



Intensity:





The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu



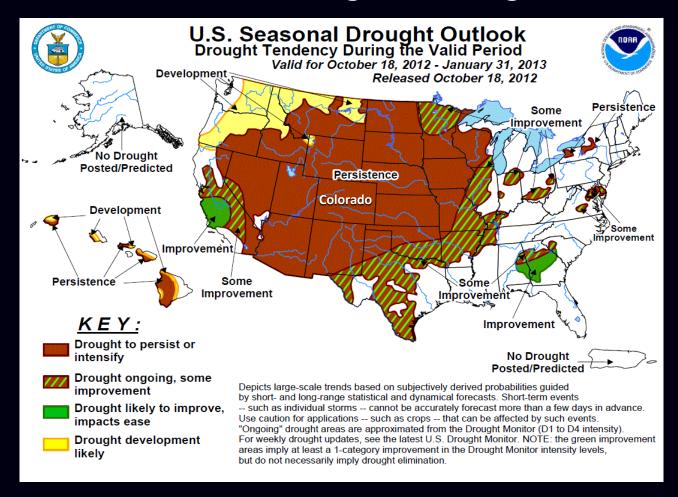
Released Thursday, October 18, 2012 Matthew Rosencrans, NOAA/NWS/NCEP/CPC

Current Drought Conditions

As of October 16, 2012, much of eastern and northwestern Colorado continued to experience extreme (D3) to exceptional (D4) drought conditions. However this is a sizable reduction in areal coverage from just 30 days ago.

The most noticeable improvement in drought conditions occurred across north central Colorado, particularly along the Front Range, where slow moving storm systems in September and early October brought soaking rainfall to the plains and snowfall to the higher elevations.

What's the Outlook for Drought in Colorado During the Coming Months?



The drought outlook for the United States for the period October 18 to January 31, 2013.

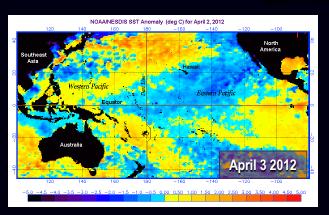
Drought conditions across Colorado are forecast to persist during this period.

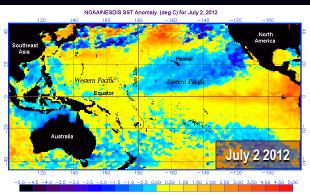
For an outlook for the entire U.S., go to www.cpc.ncep.noaa.gov/products/expert assessment/season drought.gif.

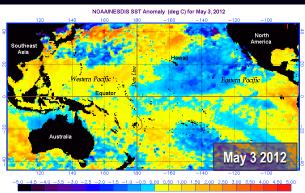


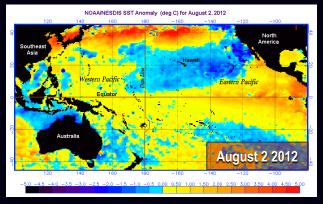
Baker - National Weather Service Boulder, Colorado

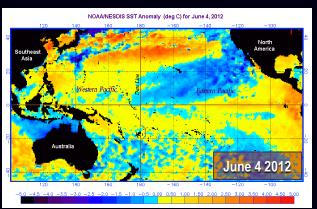
El Niño Watch Continues

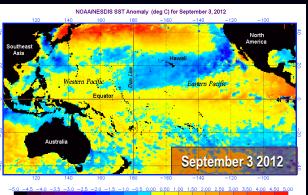






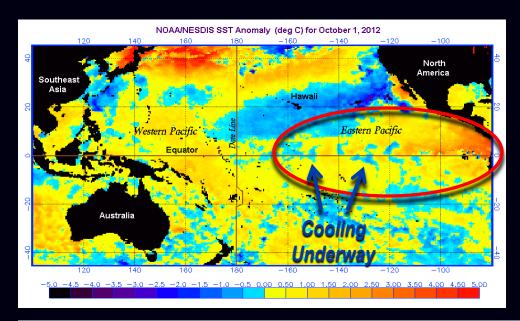




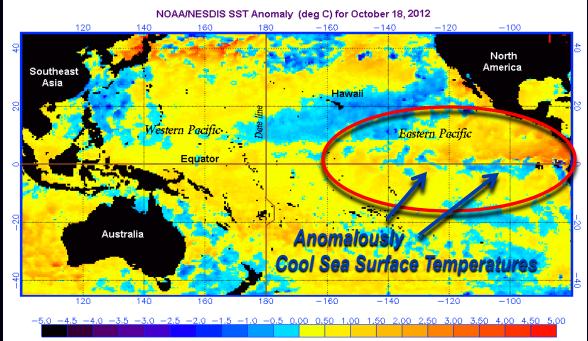


From early spring through the end of September of this year, sea surface temperature (SST) anomalies (temperature departures from normal) grew increasingly positive across the eastern tropical Pacific Ocean. Notice the westward expansion (chronologically from the upper left map to the lower right map) of positive SST anomalies (yellow and red shades) along the equator.

This greater than average warming was most pronounced along the southwest coast of Central America and the northwest coast of South America during July and August. SST anomalies in this region of the eastern Pacific exceeded 3 deg C.



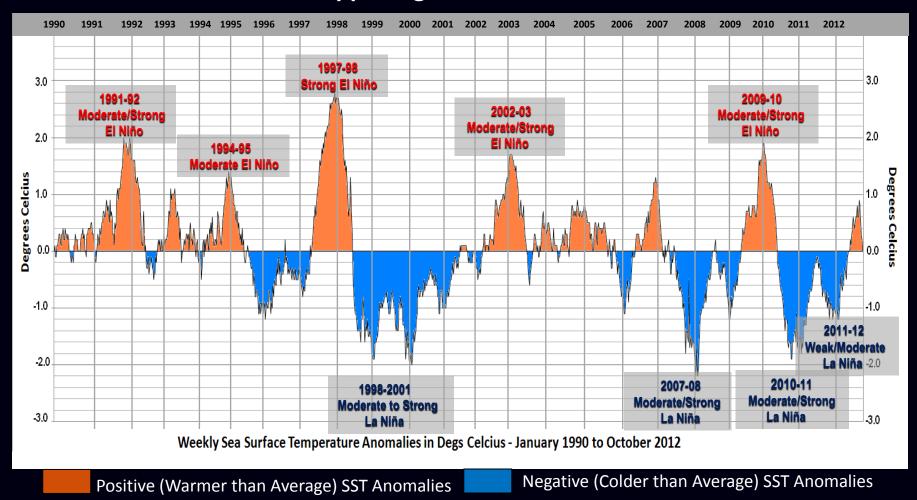
In recent weeks, however, the warmer than average surface waters in the tropical eastern Pacific Ocean have begun to cool.



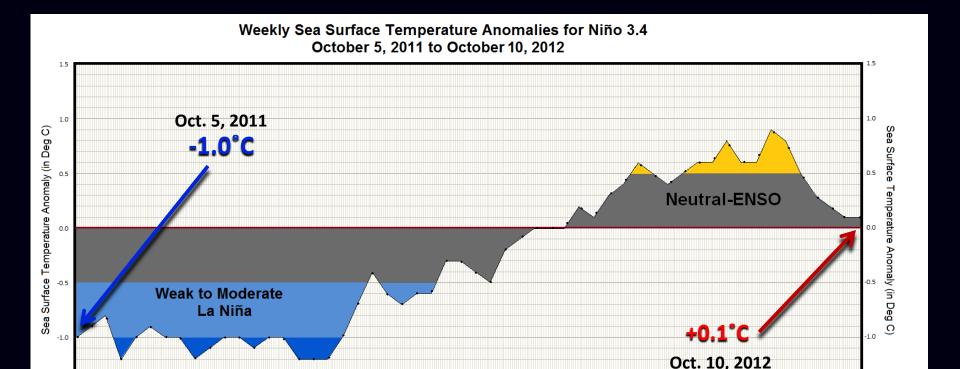
This reduction in positive temperature anomalies has been most evident along the equator east of the 145° longitude. SSTs have actually fallen to slightly below average in this region. (Note the pockets of blue shading along the equator on the adjacent maps.)

Baker - National Weather Service Boulder, Colorado

Is What is Happening in the Pacific Unusual?



No. For instance, since 1990 there have been frequent oscillations in sea surface temperatures (SSTs) above and below average. These so-called oscillations are what climate scientists use to predict the alternating phases of the El Nino/Southern Oscillation or ENSO in the Indian and Pacific Oceans. The phase when SSTs become warmer than 0.45C is referred to as an El Niño. When SSTs anomalies fall below -0.45C, we refer to this negative or cold phase as a La Niña.



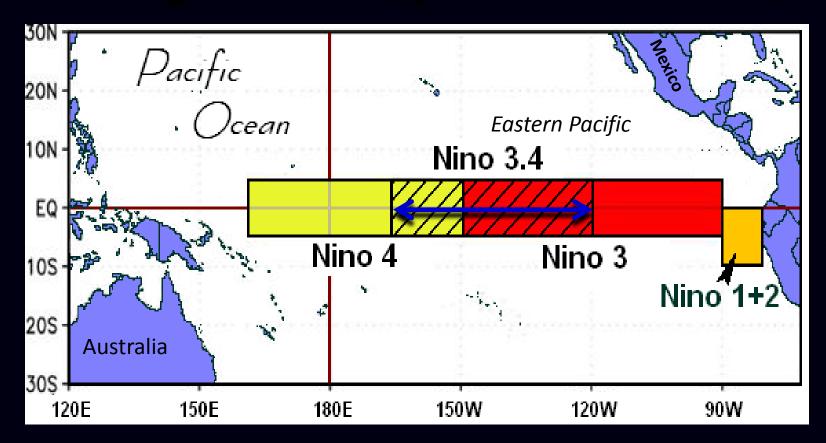
Source: NOAA/Climate Prediction Center

2011

2012

From February to June of this year, the negative weekly SST anomaly for ENSO 3.4 weakened, and by July had risen into positive territory. By the middle of September, however, the ENSO 3.4 SST anomaly steadily weakened to a value of 0.1 by October 3rd where it remained through October 10th. Even though the weekly SST anomaly for ENSO 3.4 exceeded 0.45 deg C during July, August and early September of this year, the criteria of five consecutive months of SST anomalies of at least 0.45 deg C employed by the Climate prediction Center to identify a warm phase ENSO or El Niño was not met.

Niño Regions in the Equatorial Pacific Ocean



Niño 3.4 – The principal region in the eastern Equatorial Pacific Ocean used by the Climate Prediction Center (CPC) for monitoring, assessing and predicting ENSO (hatched region on the above map).

The Oceanic Niño Index - ONI

Year	DJF	JFM	FMA	МАМ	АМЈ	МЈЈ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.7	-1.5	-1.1	-0.9	-0.8	-0.7	-0.6	-0.5	-0.5	-0.6	-0.8	-0.8
2001	-0.7	-0.6	-0.5	-0.3	-0.2	-0.1	0.0	0.0	-0.1	-0.2	-0.2	-0.3
2002	-0.2	0.0	0.1	0.3	0.5	0.7	0.8	0.8	0.9	1.2	1.3	1.3
2003	1.1	0.8	0.4	0.0	-0.2	-0.1	0.2	0.4	0.4	0.4	0.4	0.3
2004	0.3	0.2	0.1	0.1	0.1	0.3	0.5	0.7	0.7	0.7	0.7	0.7
2005	0.6	0.4	0.3	0.3	0.3	0.3	0.2	0.1	0.0	-0.2	-0.5	-0.8
2006	-0.9	-0.7	-0.5	-0.3	0.0	0.1	0.2	0.3	0.5	0.8	1.0	1.0
2007	0.7	0.3	-0.1	-0.2	-0.3	-0.3	-0.3	-0.6	-0.9	-1.1	-1.2	-1.4
2008	-1.5	-1.5	-1.2	-0.9	-0.7	-0.5	-0.3	-0.2	-0.1	-0.2	-0.4	-0.7
2009	-0.9	-0.8	-0.6	-0.2	0.1	0.4	0.5	0.6	0.7	1.0	1.4	1.6
2010	1.6	1.4	1.1	0.7	0.2	-0.3	-0.8	-1.2	-1.4	-1.5	-1.5	-1.5
2011	-1.4	-1.3	-1.0	-0.7	-0.4	-0.2	-0.2	-0.3	-0.6	-0.8	-1.0	-1.0
2012	-0.9	-0.7	-0.5	-0.3	-0.1	0.0	0.1	0.3				

NOAA/CPC Last Update 08-06-12

During the July-September 2012 climate season, the ONI of 0.3 is an indication of neutral ENSO conditions.

El Niño: ONI higher than +0.45 Neutral ENSO: ONI of -0.45 to +0.45

La Niña: ONI lower than -0.45

The ONI is based on sea surface temperature (SST) departures from average in the Niño 3.4 region of the eastern tropical Pacific Ocean. It is the principal measure used by NOAA's Climate Prediction Center (CPC) for monitoring, assessing and predicting El Niño/Southern Oscillation (ENSO.)

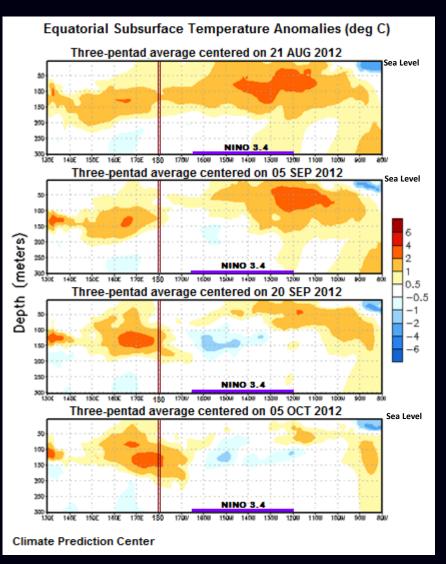
ONI is defined as the three-month running mean SST departures in the Niño 3.4 region of the Pacific.

ONI is used to place current ENSO and non-ENSO events into a historical perspective.

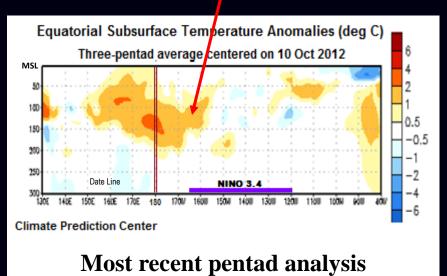
CPC's operational definitions of El Niño and La Niña are keyed to the ONI index.

For historical purposes, warm and cold phases of ENSO (the red and blue colored numbers) are defined when the threshold is met for a minimum of 5 consecutive overlapping 3-month seasons.

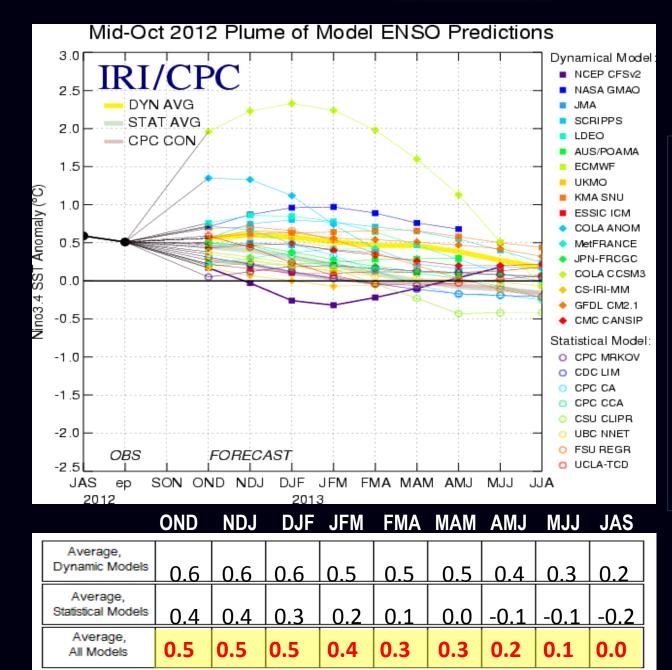
Recent Changes in Sub-Surface Temperature Departures (°C) in the Equatorial Pacific



- During the last two months, positive subsurface (upper 300 meter) temperature anomalies have weakened across the equatorial Pacific.
- However, in the past month, the region of positive subsurface temperature anomalies near the Date Line has grown and expanded eastward to region NINO3.4.



Longitude



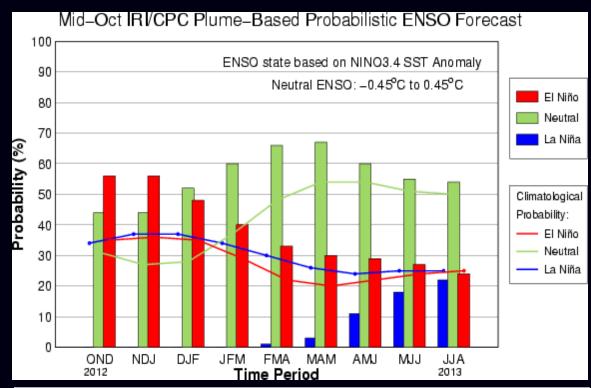
What's the Outlook for ENSO This Winter?

Nine of the 17 dynamical climate models used to forecast ENSO predict a weak El Niño during the 2012-2013 winter season. One model goes so far as to predict moderate El Niño, and another a strong El Niño. The remaining six dynamical models predict neutral ENSO conditions during the November 2012-January 2013 climate season.

A majority of the statistical climate models also predict **neutral ENSO** conditions during the upcoming winter season.

See the table provides the seasonal SST anomaly averages for Niño 3.4 through the summer of 2013.

Source: The International Research Institute for Climate and Society (IRI)



From a different perspective, the IR/CPC plume-based probabilistic ENSO forecast predicts slightly better than a 50 percent chance of El Niño during the overlapping 3-month periods October-December and November-January. For the same period, the forecast is for a 44 percent chance of neutral ENSO conditions.

IRI Probabilistic ENSO Prediction for NINO3.4 Region						
Season	La Niña	Neutral	El Niño			
OND 2012	~0%	44%	56%			
NDJ 2013	~0%	44%	56%			
DJF 2013	~0%	52%	48%			
JFM 2013	~0%	60%	40%			
FMA 2013	1%	66%	33%			
MAM 2013	3%	67%	30%			
AMJ 2013	11%	60%	29%			
MJJ 2013	18%	55%	27%			

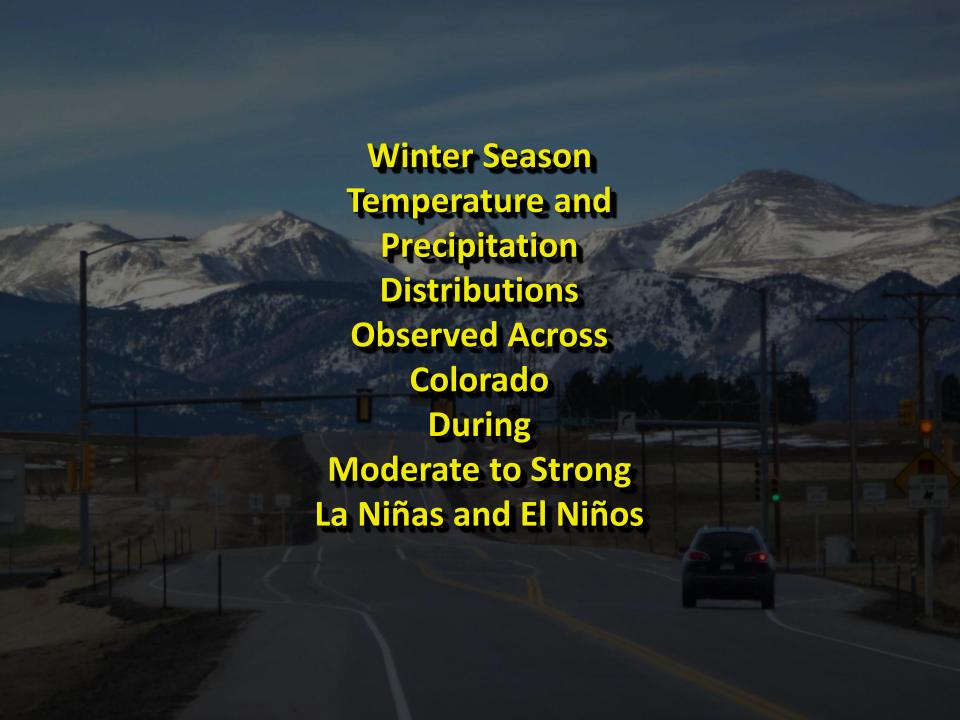
Even though El Niño conditions have yet to appear as of the end of October, an El Niño watch remains in effect because there's still a window for it to emerge in the weeks to come.

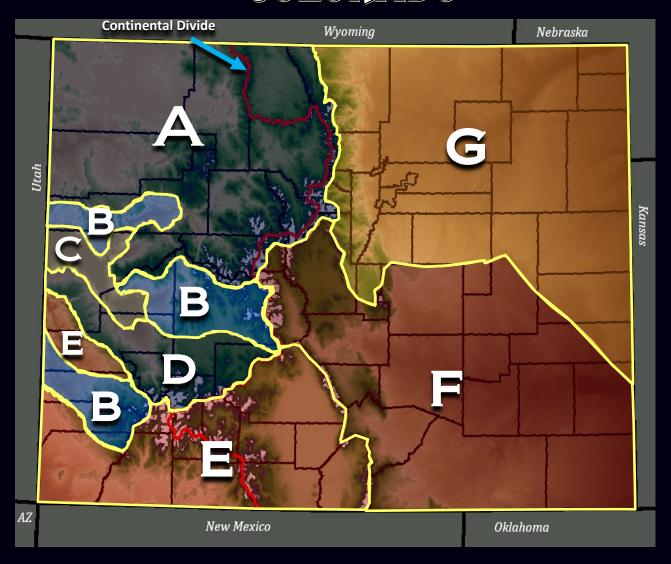
Source: The International Research Institute for Climate and Society (IRI)



During the winter of moderate to strong El Niños, a strong Pacific jet stream will often be seen steering wet and windy storm systems from the Desert Southwest and across the southern Rocky Mountain Region. Such a storm track usually results in bouts of heavy precipitation and strong winds mainly for southern and eastern portions of Colorado.

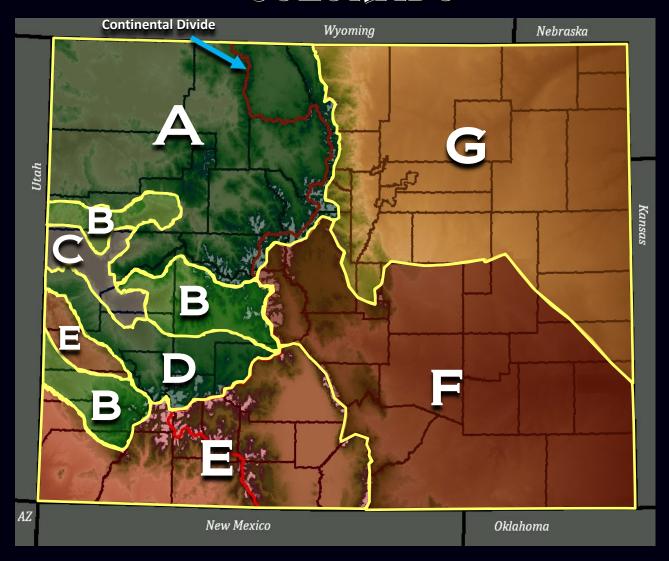
During the winter and spring of moderate to strong La Niñas, a powerful Pacific jet stream will often transport very wet and windy storm systems from the Pacific Northwest down across to the central Rocky Mountain region. These potent storm systems often produce periods of heavy snowfall and strong and gusty winds for northern and western Colorado, and strong, potentially damaging winds for the state's Front Range and high plains.





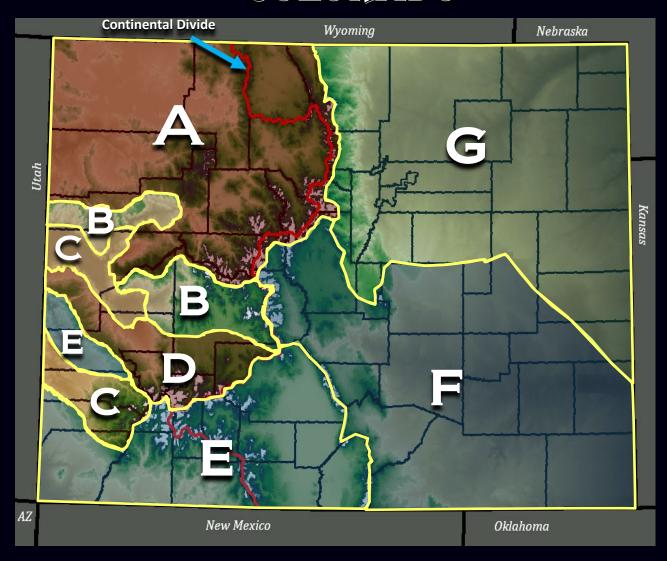
Winter Season
Temperature
Distribution
During Moderate
to Strong
La Niñas

- A Below to Much Below Average
- B Below Average
- C Near to Below Average
- D Below Average
- E Above Average
- F Above to Much Above Average
- G Near to Above Average



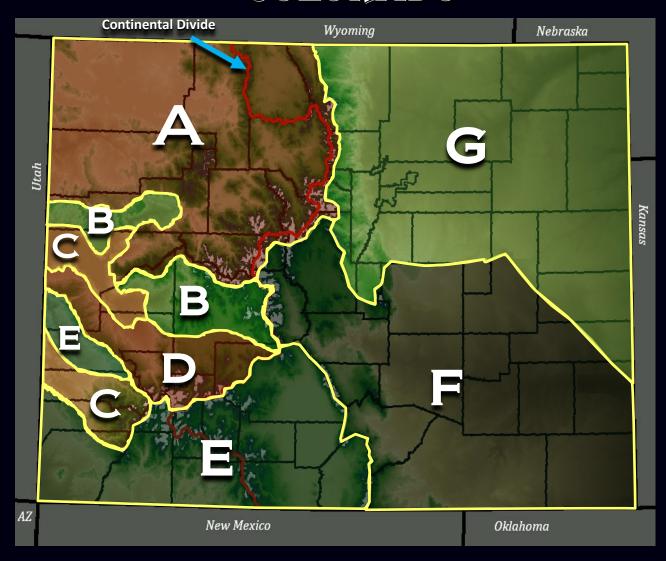
Winter Season
Precipitation
Distribution
During Moderate
to Strong
La Niñas

- A Above to Much Above Average
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- D Above to Much Above Average
- E Below Average
- F Below to Much Below Average
- G Near to Below Average



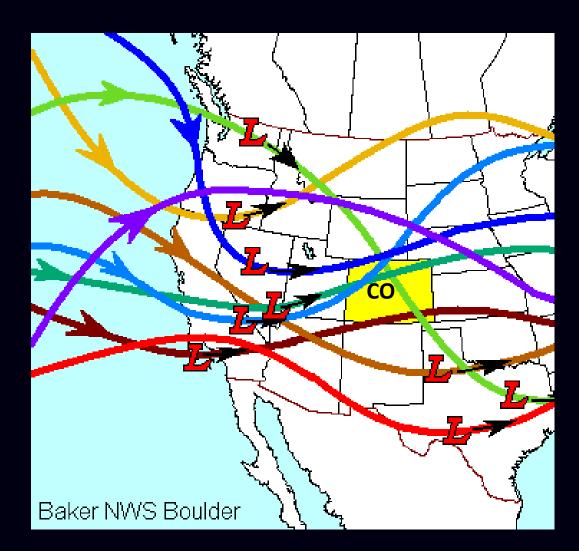
Winter Season
Temperature
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- A Above to Much Above Average
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Winter Season
Precipitation
Distribution
During Moderate
to Strong
El Niños

- A Below to Much Below Average
- B Near to Above Average
- C Near to Below Average
- D Below to Much Below Average
- E Above Average
- F Above to Much Above Average
- G Near to Above Average



So, what influence do weak
El Niños and Non-ENSO
Conditions have on
winter weather across
Colorado?

Based on a review of major storm tracks during weak El Niños of the past 30 years, Colorado will probably see a number of storm systems periodically tracking across the state. However, these storms are likely to be less intense and of shorter duration than those often associated with stronger ENSO events.

Frequency of Major Snowfalls Along the Colorado Front Range From 1950 to 2012



Since 1950 there has been 17 El Niños, 22 La Niñas and 23 non-ENSO or neutral ENSO events. In the tables, the numbers in the two left columns represent the total number and percentage of 5 and 10 inch snowfall events in Denver and Boulder since 1950. The numbers given in the two right columns represent the number and percentage of 5 and 10 inch snowfall standardized for the uneven distribution of El Niños, La Niñas and neutral-ENSO episodes. Based on these adjusted values, significant snowfalls (of at least 5 inches per storm) happened most often in Denver and Boulder during El Niño winters. Significant snowfalls occurred least often during La Niñas and neutral ENSO conditions.

Snowfall of at least 5.0 Inches

Denver	Adjusted Values				
El Nino	23	38.3%	27.3	45.5%	
La Nina	10	16.7%	9.1	15.2 %	
Neutral	27	45.0%	23.6	39.3%	

Snowfall of at least 10.0 Inches

Denver	Adjusted Values			
El Nino	26	43.3%	30.4	50.7%
La Nina	18	30.0%	16.2	27.0%
Neutral	16	26.7%	13.4	22.3%

Snowfall of at least 5.0 Inches

Boulder	Adjusted Values					
El Nino	24	40.0%	28	46.7%		
La Nina	23	38.3%	20.8	34.7%		
Neutral	13	21.7%	11.2	18.7%		

Snowfall of at least 10.0 Inches

Boulder		Adjusted Values				
El Nino	26	43.3%	30.4	50.7%		
La Nina	18	30.0%	16.2	27.0%		
Neutral	16	26.7%	13.4	22.3%		

Frequency of Major Snowfalls During ENSO and Non-ENSO Winters From 1950-2012



Winter storms depositing at least 5 inches of snow in Fort Collins also occurred most often during El Niño winters. Whereas, significant snowfall happened least often during La Niñas. The town of Sterling, located approximately 100 miles east of Fort Collins, recorded the greatest number of 5 inch snowfalls during El Niños and neutral ENSO conditions. The connection between ENSO and non-ENSO conditions to 10 inch snowfalls in Sterling could not be critically determined because of very small number of snow events of this magnitude. Therefore the numbers provided for 10 inch snowfalls at Sterling should be treated with caution.

Snow Events of >/= to 5.0 Inches

Fort Collins Adjusted Values			Values	
El Nino	23	38.3%	27.3	45.5%
La Nina	10	16.7%	9.1	15.2%
Neutral	27	45.0%	23.6	39.3%

Snow Events of >/= to 10.0 Inches

Fort Collins			Adjusted Values		
El Nino	11	40.7%	12.8	47.4%	
La Nina	7	25.9%	6.4	23.7%	
Neutral	9	33.3%	7.8	28.9%	

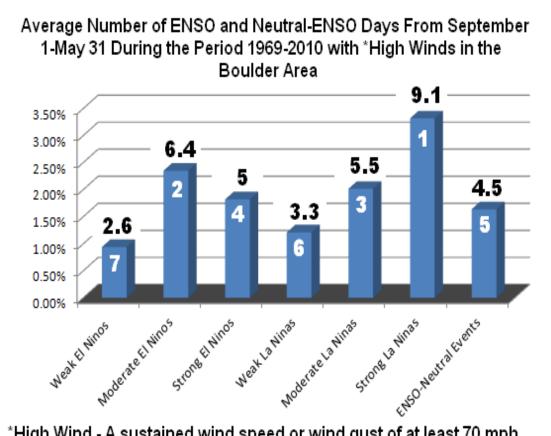
Snow Events of >/= to 5.0 Inches

Sterling	Adjusted Values				
El Nino	17	32.1%	20.5	38.7%	
La Nina	13	24.5%	12	22.6%	
Neutral	23	43.4%	20.5	38.7%	

Snow Events of >/= to 10.0 Inches

Sterling	5	Adjusted Values		
El Nino	2	66.7%	2.2	73.3%
La Nina	0	0.0%	0.0	0.0%
Neutral	1	33.3%	0.8	26.7%

Is There a Connection Between ENSO and Strong Downslope Winds Along the Colorado Front Range?



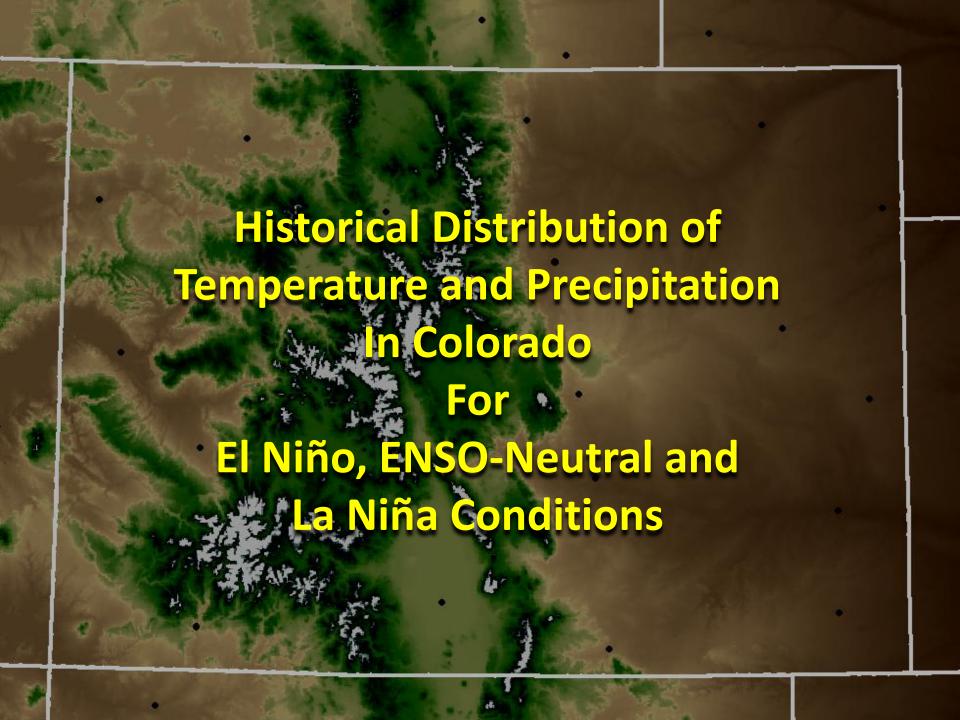
*High Wind - A sustained wind speed or wind gust of at least 70 mph and/or any straight line wind that causes considerable property damage.

Baker NWS Boulder

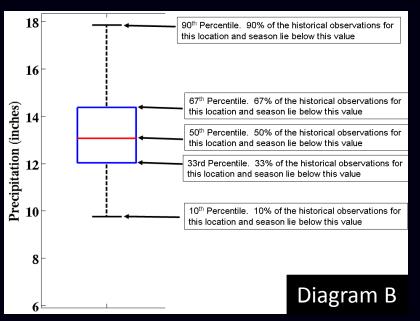
Yes, there does appear to be reasonably good link.

In a study looking at strong wind events in the Boulder area back to 1969, it was revealed that the odds of seeing *high winds in the Boulder area was greatest during strong La Niñas, followed by strong El Niños.

Conversely, high winds were least likely to occur during weak El Niños and weak La Niñas, and slightly greater during neutral ENSO conditions, or about the average number of days.



Colorado Climate Divisions Northeast Colorado Div. 046 Southeast Colorado Div. 047 Div. 099 Diagram A



Interpreting ENSO Box and Whisker Plots

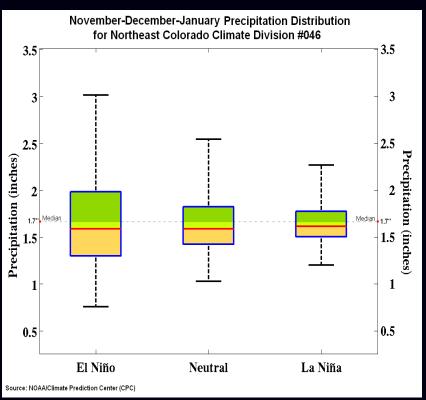
Diagram A is a map of the four climate megadivisions in Colorado used by the Climate Prediction Center (CPC)—Divisions 046, 047,048 and 099.

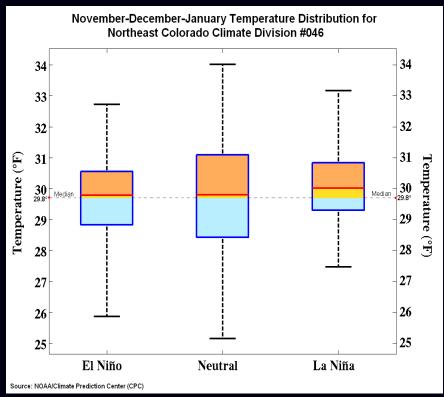
CPC has produced 3-month historical temperature and precipitation distribution plots for the three different ENSO categories —El Niño, La Niña and ENSO-neutral (non-ENSO) conditions for every climate mega-division in the United States.

Diagram B is a description of the ENSO box and whisker analysis plot used by CPC to represent historical temperature and precipitation distributions for each ENSO category pertaining to each climate division.

The red line inside the ENSO box represents the mean or 50th percentile of the data (temperature or precipitation) distribution for each climate division. Approximately 34% of the total observations exist within the ENSO box, and the remaining observations (about 66%) lie outside of the box along the whiskers extending above and below the box.

Precipitation and Temperature Composites (ENSO Box and Whisker Analysis Plots) for the Northeast Colorado Climate Division #046 for November-January



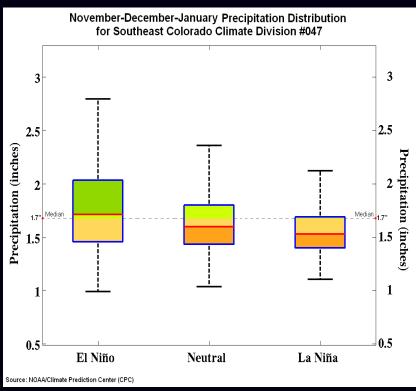


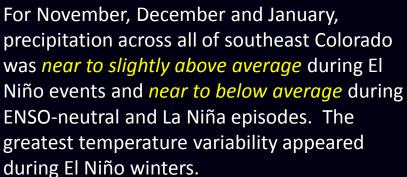
Precipitation across all of northeast Colorado for the 3 month period of November,
December and January was historically *near* average during El Niño, La Niña and neutral ENSO conditions. Precipitation also had a tendency to be more variable during El Niño events.

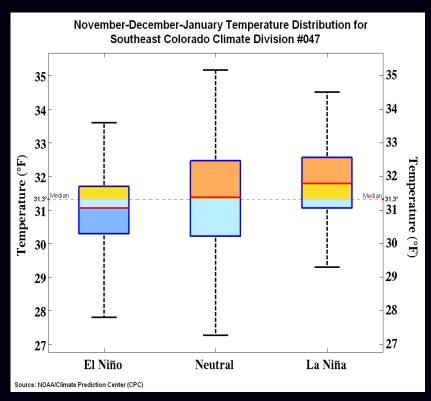
For the same period, temperatures in northeast Colorado were generally *near average* during El Niño and ENSO-neutral conditions and *above average* for La Niña events. Temperatures also had a tendency to be more variable during neutral ENSO conditions.

Baker - National Weather Service Boulder, Colorado

Precipitation and Temperature Composites (ENSO Box and Whisker Analysis Plots) for the Southeast Colorado Climate Division #047 for November-January

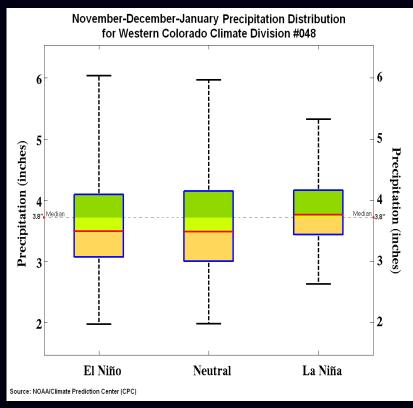




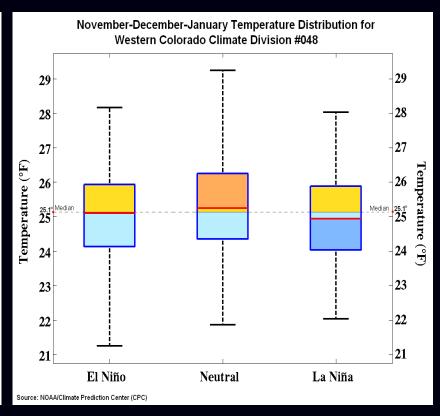


For this same three month period, temperatures were *below average* during El Niños, *near average* during ENSO-neutral, and *above average* during La Niñas. Furthermore, temperature variability was greatest during neutral ENSO conditions.

Precipitation and Temperature Composites (ENSO Box and Whisker Analysis Plots) for the Western Colorado Climate Division #048 for November-January



Precipitation across all of western Colorado during November, December and January was historically *below average* during El Niño and ENSO neutral conditions and *near average* during La Niña events.



Temperatures for the same period were *near* to slightly above average during El Niños and neutral ENSO conditions and slightly below average during La Niña events. Keep in mind, these distributions do not distinguish a difference between ENSO events of weak, moderate and strong intensity.

Concluding Remarks

- An elusive El Niño continues to challenge seasonal climate forecasters with NOAA's Climate
 Prediction Center. Forecasters say a wavering El Niño, expected to have developed by now, makes
 this year's winter outlook less certain than previous years. "This is one of the most challenging
 outlooks we've produced in recent years because El Niño decided not to show up as expected,"
 said Mike Halpert, deputy of NOAA's Climate Prediction Center.
- When El Niño is present, warmer than normal ocean water in the equatorial Pacific Ocean shifts the
 patterns of tropical rainfall eastward that in turn influence the strength and position of the Pacific
 and Polar jet streams and storms over the eastern Pacific Ocean and United States. This climate
 pattern gives seasonal forecasters confidence in how the U.S. winter will unfold. For that reason,
 "an El Niño watch remains in effect because there's still a window for it to emerge," according to
 Deputy Director Halpert.
- Other climate factors can also influence winter weather across the country. Some of these factors, such as the North Atlantic Oscillation (NAO), the Pacific Decadal Oscillation (PDO), and Pacific Inter-Decadal Oscillation (IPO), are also prominent large scale climate patterns that influence our winter weather to varying degrees. The NAO, in particular, is difficult to predict more than one to two weeks in advance, and adds uncertainty to the winter outlook for the Northeast and Mid-Atlantic portions of the country.

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2012-2013 Winter Outlook for Colorado – Summarized

- According to Climate Prediction Center's U.S. Winter Outlook, issued October 18, 2012, odds favor warmer-than-average temperatures and an "equal chance" for above-, near-, or below-average precipitation across Colorado during the November 2012 to January 2013 climate season.
- This precipitation outlook <u>does not</u> project where and when snowstorms may hit or provide total seasonal snowfall accumulations. Snow forecasts are dependent upon the strength and track of winter storms, which are generally not predictable more than a week in advance.
- Based on climate records, storm track and jet stream composites, a high wind storm frequency study for the Boulder area, and seasonal climate and ENSO outlooks prepared by NOAA's Climate Prediction Center and The International Research Institute for Climate and Society (IRI), the following weather conditions are more likely to occur in Colorado this winter season during a
- weak El Niño and/or neutral ENSO conditions:
 - 1. Above-average temperatures statewide, with odds favoring northwest and west central portions of the state
 - 2. Slightly above-average precipitation for southern portions of Colorado where storm tracks tend to favor during El Niño events, even weak ones. Otherwise, near- to slightly below-average precipitation is anticipated for the remainder of Colorado. Nonetheless, precipitation-snowfall across Colorado should be greater overall this winter season, compared to the meager amounts observed last winter.

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2012-2013 Winter Outlook for Colorado - continued

- 3. There is a reasonable chance that Colorado will see more storms this winter season as compared to last winter, although these storms are not expected to as intense or as long-lasting as those more often observed during stronger ENSO episodes.
- 4. One explanation for these weaker, shorter-lived storms; storm tracks do not normally persist over any one part of the state for days at a time during weak to neutral conditions, such as northern Colorado during moderate to strong La Niñas and southern Colorado during moderate to strong El Niños.
- 5. Strong, potentially damaging downslope winds (known as Chinook and Bora) in the Boulder area, historically have occurred least often during weak El Niño winter seasons. Their odds of occurrence increase slightly during neutral ENSO conditions, and peak during La Niña and El Niño events of strong intensity.
- 6. Lastly, according to the U.S. Drought Outlook, issued October 18, 2012, those areas of the United States, including Colorado, that were severely impacted by extreme drought over the past year are unlikely to see much relief from drought conditions this winter.